MACROINVERTEBRATE ASSESSMENT ON TWO UNNAMED TRIBUTARIES OF HAWE CREEK NEAR THE NEVADA GOLDFIELDS, INC. BARITE HILL PROJECT, McCORMICK COUNTY, SOUTH CAROLINA

August 1994

Submitted To:

NEVADA GOLDFIELDS, INC.

McCormick, South Carolina

Submitted By:

SHEALY ENVIRONMENTAL SERVICES, INC.
106 Vantage Point Drive
Cayce, South Carolina 29033
(803) 791-9700

SCDHEC Laboratory Certification No. 26103

Michael W. Heyn, Entomologist

Richard L. Shealy, President

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. SUMMARY

An assessment of the macroinvertebrate community of the two unnamed tributaries (Stream A and B) of Hawe Creek, McCormick County, South Carolina, was conducted by SHEALY ENVIRONMENTAL SERVICES, INC. on August 11, 1994. These streams receive drainage from Barite Hill Project operated by NEVADA GOLDFIELDS, INC.

The results indicate Stream B has had little or no impact from the mining operation and continues to support a relatively diverse and well balanced community, while Stream A has been impacted by surface run-off originating near the leach pond and from a newly constructed road crossing the stream approximately 20 meters downstream of the discharge from dam A. This new road has resulted in the creation of a small impoundment upstream and an increase in sedimentation downstream at the 2A sampling site.

The water chemistry parameters measured in conjunction with the macroinvertebrate assessment indicate no impact on pH, conductivity, dissolved oxygen or water temperature has occurred due to the mining operation.

II. INTRODUCTION

On August 11, 1994, SHEALY ENVIRONMENTAL SERVICES, INC. (SCDHEC Laboratory Certification No. 26103) conducted a macroinvertebrate community assessment on two unnamed tributaries of Hawe Creek, which are potentially impacted by the Barite Hill Project operated by NEVADA GOLDFIELDS, INC. The objective of this study was to determine the present condition of the stream communities.

III. DESCRIPTION OF STUDY AREA

Collections macroinvertebrates were made from an upstream and downstream site on each of the two streams (Figure 1). The physical characteristics of the streams were similar at all of the sampling locations; alternating between shallow sand bottom pools and riffles composed of gravel and cobble. Station 1A served as the reference site for stream A. The stream at this location flows through a mixed hardwood forest and is approximately 1.5 to 2.5 meters wide with a depth 0.5 meters in the riffle areas and 0.75 meters in the pools.

Station 2A was located approximately one hundred meters downstream of the mine site. The stream at this location was similar to the reference site with alternating shallow riffle areas and 0.5 - 1.0 meter deep pools.

Station 1B served as the reference site for stream B. The stream at this location flowed through a mixed hardwood forest. This stream was similar to stream A in physical characteristics with a width of 1.0 to 2.5 meters. The depth ranged from 0.1 meters in the riffle areas to 1.0 meters in the pools. Station 2B was located approximately 20 meters downstream of the confluence with a small order first branch running parallel to the mine site.

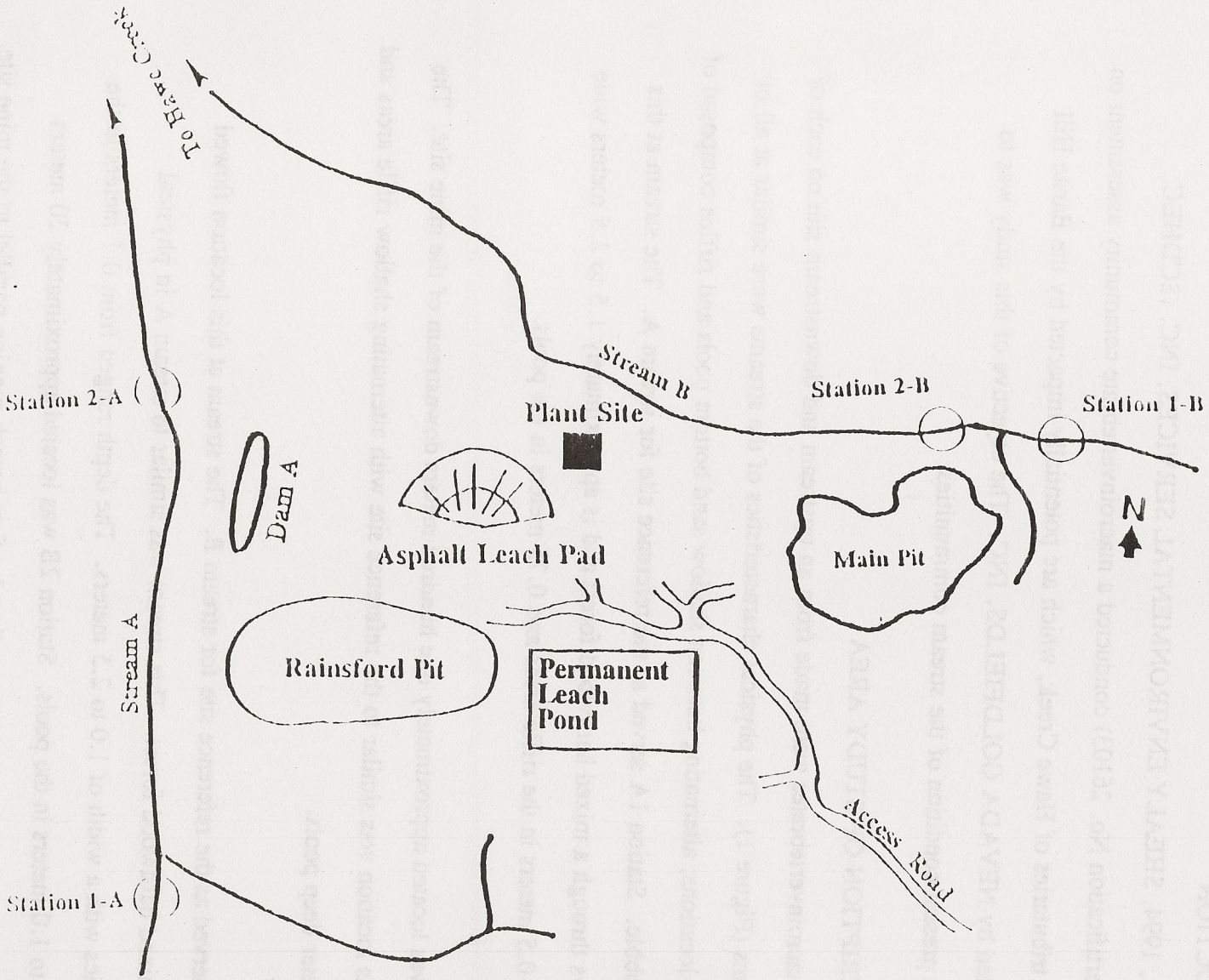

Figure 1. Sampling station on the two unnamed tributaries of Hawe Creek receiving drainage from the Barite Hill Project operated by NEVADA GOLDFIELDS, INC., McCormick County, South Carolina.

The characteristics were essentially the same as those of station 1B, with alternating shallow riffle areas and pools.

IV. METHODS AND MATERIALS

Qualitative collections of aquatic macroinvertebrates were made with a D-frame aquatic dip net, a U.S. Standard No. 30 sieve, and by hand picking organisms from substrates with forceps. The multiple habitat approach, where specimens from all available habitats (stream margins, leaf packs, aquatic vegetation, water-soaked logs and sand deposits) are pooled to form one aggregate sample was utilized as the sampling procedure. Samples were preserved in the field with 70% Ethanol. Each sample represents 45 minutes of sampling effort by two biologists (1.5 man hours per station). Sampling procedures and habitat types were kept similar at each station to enable species and numerical population comparisons between stations.

Water chemistry parameters taken at each station in conjunction with the macroinvertebrate sampling were: pH (Orion Model 290A), conductivity (Yellow Springs Instrument Model 33), and dissolved oxygen and temperature (Yellow Springs Instrument Model 57).

Upon return to the laboratory, macroinvertebrate collections were sorted from debris with the aid of a stereo microscope. The macroinvertebrates were identified to the lowest positive taxonomic level and counted with the aide of appropriate microscopic techniques and taxonomic keys. All macroinvertebrates collected will be maintained in SHEALY ENVIRONMENTAL SERVICES, INC.'s voucher collection for three years or placed into our permanent reference collection.

Comparison of the macroinvertebrate communities was based on changes in taxonomic composition between sampling sites and on known tolerance levels and life history strategies of

the organisms encountered. Changes in taxonomic composition were determined using the metrics outlined in Protocol III of the USEPA's rapid bioassessment procedures (Plafkin et al. 1989). These metrics included the following: 1) taxa richness or the number of different taxa found at a particular station, which is an indication of diversity; 2) EPT Index, the number of taxa from the insect orders Ephemeroptera, Plecoptera, and Trichoptera found at a station. These three insect orders are considered to be intolerant of adverse changes in water quality, especially temperature and dissolved oxygen, and therefore, a reduction in these taxa is indicative of reduced water quality. 3) Chironomidae taxa and abundance, the Chironomidae are a taxonomically and ecologically diverse group with many representatives which are tolerant and many which are intolerant of various forms of pollution. 4) Ratio of EPT and Chironomidae abundance, uses relative abundance of these indicator groups as a measure of community balance, good biotic conditions is reflected in communities having a fairly even distribution among the four groups. 5) Ratio of scraper/scraper and filtering collector and 6) shredder/total functional feeding groups, when compared to a reference site, shifts in the dominance of a particular feeding type may indicate a community responding to an overabundance of a particular food source or toxicants which are bound to a particular food source. 7) Percent contribution of dominant taxon, and 8) dominant taxa in common are indicators of community balance, a community dominated by relatively few species or major shifts in dominant taxa can indicate environmental stress. 9) Community loss index, measures the loss of taxa between a reference or control station and a study site and is an index of dissimilarity, with value increasing as the degree of dissimilarity from the reference station increases. 10) Jaccard Coefficient of Community Similarity, measures the degree of similarity in taxonomic composition between two stations in terms of taxon presence or absence. Values range from 0 to 1.0, increasing as the degree of similarity increases. 11) The North Carolina biotic index (NCBI) for Southeastern streams (Lenat, 1993), with values range from 0 - 10, increasing as water quality decreases.

V. RESULTS AND DISCUSSION

A. Physicochemical Analysis

The water chemistry data taken in conjunction with the macroinvertebrate collections are given in Table 1. None of the measured parameters (temperature, dissolved oxygen, pH and conductivity) appear to be affected by the operation of the mine and all were within the standards for Class FW waters established by the state of South Carolina (SCDHEC, 1993).

Table 1. Physicochemical data collected from two unnamed tributaries of Hawe Creek Near the NEVADA GOLDFIELDS, INC.'s. Barite Hill Project August, 1994.

	Stream A		Stream B	
Parameters	1	2	1	2
Water Temp. (^{O}C)	24.0	23.0	21.0	19.0
pH (SU)	6.91	6.79	7.20	7.17
Conductivity (umhos/cm)	625	280	170	180
Dissolved Oxygen (mg/l)	7.3	6.8	6.0	5.8

B. Macroinvertebrate Community Analysis

The results of the macroinvertebrate community analysis are presented in Table 2. A total of 138 specimens representing 37 taxa were collected from Stream A and of 143 specimens representing 31 taxa were collected from Stream B.

Stream A

The control site (Station 1A) yielded 114 specimens representing 30 taxa. An EPT index of 7 was calculated for this station. The Chironomidae were represented by 6 taxa. The dominant taxon was the *Chimarra* sp. which represented 19.3% of the specimens collected. The North Carolina biotic index value of 6.49 was calculated for this station resulting in a water quality rating of good-fair.

The study site (station 2A) yielded 24 specimens representing 10 taxa. An EPT index of 1 was calculated for this station. The Chironomidae were represented by 1 taxa. *Gerris* sp, *Trepobates* sp. and *Sialis* nr. *aequalis* were the dominant taxa and each contributed 20.8% of the specimens. The community less index and the Jaccard coefficient of similarity indicated this site to be dissimilar to the control. The North Carolina biotic index value of 7.03 results in a water quality rating of fair.

Stream B

The reference site (station 1B) yielded 71 specimens representing 24 taxa. An EPT index of 6 was calculated for this station. The Chironomidae were represented by 10 taxa. The dominant taxon was *Stenacron interpunctatum.* which contributed 18.3% of the specimens collected. The NCBI value of 7.00 results in a water quality rating of fair for this station.

The study site (station 1B) yielded 72 specimens representing 22 taxa. An EPT index of 4 was calculated for this station. The Chironomidae were represented by 7 taxa. The dominant taxon was *Chimarra* sp. which contributed 18.1% of the specimens collected. The community loss index and the Jaccard coefficient of similarity indicate this station is relatively different from the control. The NCBI value of 5.87 results in a water quality rating of good.

IV. CONCLUSIONS

The results of this macroinvertebrate community assessment indicate little or no impact has occurred to Stream B during the assessment period and that Stream A has been impacted by surface run-off originating near the leach pond and from the constriction of a new road which crosses the stream approximately 20 meters downstream of dam A. This new road has created a small impoundment upstream and has resulted in increased sedimentation downstream at the 2A sampling site.

VII. REFERENCES

Lenat, D.R. 1993. A biotic index of the southeastern United States: derivation and list of tolerance values, with criteria for assigning water-quality ratings. J. Am. Benthol. Soc. 12:279-290.

South Carolina Department of Health and Environmental Control. 1985. Water classifications and standards (Regulation 61-68), water classifications (Regulation 61-69) State of South Carolina. Office of Environmental Quality Control, SCDHEC, Columbia, South Carolina

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross and R.M. Hughes 1989. Rapid bioassessment protocols for use in streams and rivers. USEPA Assessment and Watershed Protection Division, Washington, D.C.EPA/444/4-89/001.

Table 3. Macroinvertebrates collected from two unnamed tributaries (Streams A and B) of Hawe Creek near the Barite Hill Project, August 11, 1994.

Taxon	TV[1]	FG[2]	STATIONS 1A	2A	1B	2B
Turbellaria						
Planariidae						
Dugesia sp.	7.5	P	1			
Annelida						
Branchiobdella						
Cambarincola sp.	----	P			4	
Arthropoda						
Arachnoidea						
Hydracarina sp.	5.7	P	1			
Decapoda						
Cambaridae						
Cambarus sp.	8.1	H	1		5	5
Hexapoda						
Ephemeroptera						
Baetidae						
Baetis sp.	4.4	CG	1			
Caenidae						
Caenis sp.	7.6	CG	10			
Heptageniidae						
Stenacron interpunctatum	7.1	SC			13	3
Stenonema modestum	5.8	SC	8		8	
Odonata						
Aeshnidae						
Boyeria vinosa	6.3	P	1			
Calopterygidae						
Calopteryx maculata	8.3	P	16			3
Coenargrionidae						
Argia sedula	8.7	P	6			
Enallagma spp.	9.0	P	14		3	1
Corduliidae						
Somatochlora c.f. *elongata*	8.9	P	1	1	2	1
Gomphidae						
Gomphus spp.	6.2	P	1		1	
Heteroptera						
Gerridae						
Gerris sp.	----	P		5		
Trepobates sp.	----	P	1	5	2	7
Veliidae						
Microvelia sp.	----	P		1		3
Megaloptera						
Corydalidae						

[1] NCBI Tolerance Value

[2] Functional Feeding Group: CF=Collector-filterer; CG=Collector-gatherer; H=Herbivore, P=Predator; SC=Scraper; SH=Shredder

Table 3. Continued

Taxon	TV	FG	STATIONS 1A	2A	1B	2B
Nigronia fasciatus	6.2	P			3	2
Sialidae						
Sialis nr. *aequalis*	7.5	P		5		
Trichoptera						
Hydropsychidae						
Cheumatopsyche sp.	6.6	CF	2		2	3
Hydropsyche betteni	8.1	CF	2		1	
Limnephilidae						
Neophylax ornatus	1.6	SC	4			
Pycnopsyche sp.	2.3	SH		2	1	4
Philopotamidae						
Chimaarra sp.	2.8	CF	22		1	13
Coleoptera						
Dryopidae						
Helichus basalis	5.4	SC			3A	3A
Helichus fastiagatus	5.4	SC	1A			
Dytiscidae						
Hydroporus carolinus	8.9	P	1A			
Hydroporus hybridus	8.9	P			3A	1A
Hydroporus mellitus	8.9	P			1A	
Laccophilus rufus	10.0	P		2A		
Elmidae						
Dubiraphia bivittatus	6.4	CG	6A		1A	
Macronychus glabratus	4.7	CG		1A		
Haliplidae						
Peltodytes duodecimpunctatus	8.5	SH	1A			
Diptera						
Chironomidae						
Conchapelopia sp.	8.7	P	1	1		
Corynoneura sp.	6.2	CG	1			
Dicrotendipes sp.	7.9	CG				1
Microtendipes sp.	6.2	CG	3		6	
Nanocladius sp.	7.2	CG				3
Parametriocnemus lundbecki	3.7	CG				1
Paratendipes albimanus	5.3	CG			3	
Polypedilum illinoense	9.2	CG	1		3	1
Procladius sp.	9.3	P			1	
Rheotanytarsus spp.	6.4	CF	1		1	5
Tanytarsus spp.	6.7	CG	3		1	3
Tribelos jucundum	6.6	CG				7
Culicidae						
Anopheles sp.	9.1	CF	1		2	1
Tabanidae						
Silvius sp.	—	P		1		
Mollusca						
Gastropoda						
Ancylidae						
Ferrissia	6.9	SC	1			1

Table 3. Continued

Taxon	TV	FG	STATIONS 1A	2A	1B	2B
Physidae						
Physella sp.	9.1	SC	1			
Taxa Richness			30	10	24	22
Number of Specimens			114	24	71	72
EPT Index			7	1	6	4
EPT Abundance			49	2	26	23
Chironomidae Taxa			6	1	6	7
Chironomidae Abundance			10	1	15	21
EPT/Chironomidae Abundance			4.9	2.0	1.73	1.10
North Carolina Biotic Index			6.49	7.03	7.00	5.87
Percent Collector-filterers			24.6	0	9.9	30.6
Percent Collector-gatherers			21.9	4.2	19.7	22.2
Percent Herbivores			0.9	0	7.0	6.9
Percent Predators			38.6	87.5	28.2	25.0
Percent Scrapers			13.2	0	33.8	9.7
Percent Shredders			0.9	8.33	1.4	5.6
Scraper/Scraper & Collector-filterers			0.35	0	0.77	0.24
Shredders/Total			0.01	0.08	0.01	0.06
Percent Dominant Taxon			19.3	20.8	18.3	18.1
Number of Dominant Taxa			6	5	5	6
Dominants in Common			----	0	-----	1
Community Loss Index			----	2.7	-----	0.41
Jaccard Coefficient of Similarity			----	0.08	-----	0.48